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ABSTRACT

An invitational conference was convened to examine the use of microcomputers in public school education. Conference presentations summarized in this document offer overviews of instructional computing and discuss software development and evaluation, classroom and laboratory applications, and policy matters regarding software and hardware selection. Other presentations investigate the applicability of actual software in the areas of mathematics and science, special education/special needs, and teacher performance evaluation. In the concluding session, representatives from each participating state department, region, district, and school were invited to discuss the use of computers as educational tools in their respective states; paragraph-length statements report microcomputer futures and options in Arkansas, Louisiana, Mississippi, Oklahoma, New Mexico, and Texas. (RH)

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R & D SPEAKS:

EFFECTIVENESS OF MICROCOMPUTERS IN EDUCATIONAL APPLICATIONS

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CONFERENCE PROCEEDINGS

R&D SPEAKS:

EFFECTIVENESS OF MICROCOMPUTERS IN EDUCATIONAL APPLICATIONS

SEPTEMBER 27-28, 1983

Southwest Educational Development Laboratory
Austin, Texas

ACKNOWLEDGEMENTS

I want to thank the staff of the SEDL Regional Exchange for their preparation for and convening of this R&D SPEAKS: EFFECTIVENESS OF MICROCOMPUTERS IN EDUCATIONAL APPLICATIONS. Special thanks is extended to Linda A. Lloyd, Conference Coordinator. The conference, as is true of all her work with the Regional Exchange, demonstrated her hard work and dedication to sound applications of technology in education. Barbara Lecroy, Administrative Assistant; Claire J. Waring, Administrative Secretary; and Diane E. Downing, Technical Writer, all made major contributions.

May I also express my appreciation to each one of the presenters, all of whom contributed greatly to making the conference a success: Dr. George Culp, Dr. Judah Schwartz, Dr. Randy Elliot Bennett, Dr. Charles Harrison, and Dr. Floyd Ploeger. Thanks are due to the following businesses and institutions for their assistance and contributions: the MicroCenter, Pleasantville, NY; Scholastic, Inc., Englewood Cliffs, NJ; ERIC Clearinghouse, Urbana, IL; Sunburst Communications, Pleasantville, NY; and Education Service Center Region XIII, Austin, TX.

The following persons also offered their time and technical expertise in order to assure that the conference would be a valuable and rewarding one: Dr. Dave Van Antwerp, the Computer Center, Austin, TX; Arnold Kriegel, Southwest Educational Development Laboratory, Austin, TX; Ed Zaiontz, Region XIII, Austin, TX; and Bill Jorn and the Video Crew, Austin Community College, Austin, TX.

Martha L. Smith
Project Director
Regional Exchange Project

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Conference Overview -- R&D Speaks: Effectiveness of Microcomputers in Educational Applications

On September 27-28, 1983 the Regional Exchange Project of the Southwest Educational Development Laboratory convened an invitational R&D Speaks Conference on "Effectiveness of Microcomputers in Educational Applications." The participants were representatives from the state departments of education, regional agencies, school districts, and schools from the six states of Arkansas, Louisiana, Mississippi, New Mexico, Oklahoma, and Texas.

The participants and members of the SEDL Regional Exchange staff discussed issues in instructional microcomputing together with the conference presenters: Dr. George Culp, Assistant Director of the Computation Center, University of Texas at Austin; Dr. Judah Schwartz, Professor of Engineering Science and Education, Massachusetts Institute of Technology; Dr. Randy Elliot Bennett, Research Scientist, Educational Testing Service; and Dr. Floyd Ploeger, Staff Associate, SEDL Regional Exchange Project.

The purpose of the conference was to address issues and options in the effective use of microcomputers in public school education. As Dr. Martha Smith, Director of the Regional Exchange Project, noted in her introductory remarks, the participants were gathered in Austin to share ideas and working concepts about a critical area of educational practice. Dr. Preston Kronkosky, Executive Director of SEDL, paraphrased John Naisbitt's catchphrase of "automate, immigrate, or evaporate" as being applicable to schools as well as industry -- schools must either learn to employ the microcomputer effectively or go to another country or go out of business.

The first and last presentations gave overviews of instructional computing and discussed critical issues in software development and evaluation, classroom and laboratory application, and policy matters regarding software and hardware selection. The other three presentations featured extensive demonstrations of actual software in the areas of mathematics and science, special education/special needs, and teacher performance evaluation. Extensive participant discussion followed each presentation, and the conference was concluded by a state-by-state roundup of current trends and activities. The conference also featured a hands-on demonstration center for exemplary software and other educational materials related to math and science, special education, and teacher evaluation.

A G E N D A

R&D SPEAKS: Effectiveness of Microcomputers in Educational Applications

September 27-28, 1983
Southwest Educational Development Laboratory
Austin, Texas

TUESDAY, SEPTEMBER 27, 1983

8:00-8:30 a.m.	Coffee and Conversation, Registration
8:30-8:45 a.m.	INTRODUCTIONS Dr. Martha L. Smith Director, Regional Exchange Linda A. Lloyd Dissemination Specialist
8:45-9:30 a.m.	KEYNOTE ADDRESS: "Microcomputers in Education: Are We Forcing the Opportunity or Missing It?" Dr. George Culp University of Texas-Austin
9:30-11:30 a.m.	MATHEMATICS AND SCIENCE APPLICATIONS Dr. Judah Schwartz MIT Cambridge, Massachusetts
11:30-1:00 p.m.	**LUNCH ON YOUR OWN**
1:00-2:45 p.m.	SPECIAL EDUCATION APPLICATIONS Dr. Randy Elliot Bennett ETS Princeton, New Jersey
2:45-4:30 p.m.	EVALUATION: TEACHER PERFORMANCE Dr. Charles Harrison Assistant Superintendent Tunica County Public Schools Tunica, Mississippi

4:30-5:00 p.m.	Questions and Discussion
5:00 p.m.	**DISMISS FOR THE DAY**

WEDNESDAY, SEPTEMBER 28, 1983

8:00-8:30 a.m.	Coffee and Conversation
8:30-9:45 a.m.	ROUND-TABLE: Observation about Practices and Trends in Educational Microcomputing: o Martha L. Smith o Diane E. Downing o Linda A. Lloyd o Floyd D. Ploeger
9:45-10:00	**BREAK**
10:00-12:00 noon	STATE ROUND-UP: SEDL/RX staff and participants will discuss educational futures and options for the uses of the microcomputer as an educational tool. Representatives from each state department, region, district, and/or school will be invited to share innovations and ideas dealing with educational computing in the classroom. Wrap-up and Summary Comments
12:00 Noon	**DISMISS**

"Microcomputers in Education: Are We Forcing the Opportunity or Missing It?"
Keynote Address, Dr. George Culp, University of Texas-Austin

DR. GEORGE CULP

DR. CULP is the Assistant Director of the Computation Center at the University of Texas, Austin, Texas. He serves as Senior Lecturer in the Departments of Computer Science and Curriculum and Instruction at the University of Texas/Austin. Dr. Culp is involved in teacher training and instructional computing technology (particularly at the secondary level). He currently has two new books in print, with two additional volumes in press, which deal with educational microcomputers and instruction. Dr. Culp is a charter member of TCEA (Texas Computer Education Association) and is a steering committee member for AFIPS (American Federation of Information Processing Societies). Areas of research that interest Dr. Culp include software development and innovative uses for the microcomputer as an instructional tool. Dr. Culp currently serves on the editorial review panel for the Journal of Computers in Mathematics and Science Teaching and Educational Technology.

Dr. George Culp first presented an overview of the extent of microcomputing in education. In June 1983 there were 291,000 machines in the schools. It is projected that by 1988 there will be two million microcomputers in the schools, and that by the end of the decade there will be one microcomputer for each schoolchild. Typical uses of microcomputing include (1) problem-solving with discipline-oriented problems; (2) drill and practice such as the program in medical and scientific terminology at UT-Austin in which students work with Latin and English; (3) simulation, which is usually based on mathematical models in the physical and social sciences; and (4) tutorial dialogue with branching to sub-concepts or another program. In courseware development, it usually takes 250 person-hours to develop one hour of student interaction.

Culp gave several examples of what he termed "forced opportunities" in educational microcomputing. One is the frequent situation in which a teacher gets a microcomputer but does not know how to use it. Another is the

situation in which a three-hour course supposedly makes a teacher "computer literate" for teacher certification requirements.

Far more serious, however, are "missed opportunities," which includes a "wait and see" attitude when a district decides to wait six months for more advanced equipment or more suitable software and misses the opportunity to employ the microcomputer as an educational tool. Another example occurs when a school district purchases fifty $100 computers which are "one step above hand-held calculators" in their limited applicability to classroom situations. A third example is lack of trained personnel with an appropriate hardware and courseware acquisition sequence. Computer awareness is only a minimum training goal, according to Culp. Another missed opportunity occurs when teachers do not write their own software, a task which is equivalent to writing a section within a chapter, rather than a whole textbook.

In conclusion, Culp remarked, "Society may forgive those educators who force the opportunity but never those who miss the opportunity."

"Mathematics and Science Applications," Dr. Judah Schwartz, M.I.T., Cambridge, Massachusetts

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DR. JUDAH SCHWARTZ

DR. SCHWARTZ is a Professor of Engineering Science and Education at the Massachusetts Institute of Technology and is a visiting Professor of Education at Harvard University. He has conducted many studies and investigations into human learning and is most interested in the ways in which people deal with symbols and abstractions. Dr. Schwartz's most recent book, published by Addison-Wesley, is entitled Personal Problems: Microcomputer Software for Undergraduate Physics. Recent additions to the volumes of software that Dr. Schwartz has designed include the Semantic Calculator and Missing Links: A Game of Language and Letters. Dr. Schwartz is currently serving as Senior Consultant to the Center for Learning Technology at the Educational Development Center. He also is on the national advisory council for the Children's Television Workshop, and is a

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Dr. Judah Schwartz presented a demonstration of uses of computers as a tool of instruction in math and science from the middle school on up, stating that the crisis in science is not that no one knows how to compute but rather that no one knows calculus and physics. He prefaced his demonstration with a "scale of permissiveness" in instructional computing from tyranny (or discipline) to license (or freedom). In the former, a situation which is descriptive of old mainframe CAI, the computer runs the conversation, must infer the intentions of the user, and is a tool for the teacher not the learner. In the software designed by Schwartz, the opposite characteristics predominate: the student runs the conversation, the program does not infer intentions, and the computer is the tool of the learner. Schwartz made the observation that when computers get to the point of doing drill and practice well, then parents will wonder about the necessity of schools as institutions and will question why the drill and practice cannot be done elsewhere.

Schwartz's demonstration software had several significant characteristics: it gave no "cute" feedback, it featured approximations so there were no "wrong" answers, and it incorporated "mistakes" into the feedback; i.e., it showed the learner the consequences of his or her actions immediately. Several programs featured approximations in addition and multiplication, in decimals, and in coordinates. They were designed to help learners to think seriously about their search strategies, particularly the technique of binary search. Schwartz suggested Paul Heuse's The Issue of Measurability as a useful tool for these programs. He also demonstrated a segment from his program "semantic calculator," outlining approaches for teaching resolutions of the "three apples, six oranges" type, as well as programs taken from his physics publication Personal Problems on the four inner planets and projectile

motion. He demonstrated a geometric supposer and algebra using a series of transformations rather than an arithmetic "right" answer. He concluded by saying that this demonstration software illustrated the "license" end of the permissiveness spectrum, in that it is open-ended and it allows the teacher and the students to explore the domain of the curriculum.

"Special Education Applications," Dr. Randy Elliot Bennett, ETS, Princeton, New Jersey

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DR. RANDY ELLIOT BENNETT

DR. BENNETT is a Research Scientist at the Educational Testing Service (ETS) in Princeton, New Jersey, where he currently is directing a support network for 101 schools. Initiated in May of 1983, the IBM Secondary School Computer Education Program involves sharing of information and techniques in classroom computing information among designated schools nation-wide, including several schools for the deaf, emotionally disturbed, and learning disabled. Dr. Bennett is also involved in writing a series of research articles on the validity of academic admissions tests for handicapped students. Dr. Bennett has a book in progress, co-authored by Charles Maher, entitled Planning and Evaluation of Special Education Services, to be released by Prentice-Hall in January of 1984.

Dr. Randy Bennett first presented issues of microcomputers in special education in terms of a conceptual framework. In his grid representation he categorized the computer as tutor, tool, and tutee and the user as student and professional.

	Tutor	Tool	Tutee
Student	Tutorial Drill & practice Learning games	Word processor Speech synthesizer Data base manager	Programming language
Professional	Tutorial Simulation	CMI Information manager	Authoring language

He remarked that frequently the computer as tool (i.e. with voice synthesizer, expanded keypad, larger screen) is not necessary with a large percentage of the special education population. Many of the special education programs are high-control tutorial (tyrannical, in Schwartz's terminology) or drill and practice, as in spelling programs in which the student is to choose one of four spellings for a given sentence.

He demonstrated one MECC (Minnesota Educational Computer Consortium) program on basic measurement concepts with quarts and gallons of milk. It was pointed out that there were problems with the visual representation of the jug in that it did not show a 1:4 ratio and in that it was not a container type familiar to children. The program illustrated an isolated example of a common software shortcoming (unfamiliar terminology or graphic representations which generalize poorly in "real life").

Bennett next demonstrated the PFS File System by showing how it could be used to create a data base of baseball names, homeruns, averages, and runs. Tactics for planning, searching, and mathematical matches could be used by students. Bennett remarked that there is always a trade-off between power of the software and ease of use and that PFS Write is an exceptionally easy-to-use word processor for special education students. Under the category of tutee Bennett said that student programming of microcomputers is important for future employment. Even though research does not support the fact that learning to program fosters cognitive skills, this is an important part of instructional microcomputing. He concluded his demonstration by showing Big Trac, a programmable tank toy appealing to special education students, which can be used to demonstrate graphically capabilities of LOGO-type materials.

Bennett closed his remarks by listing some of the considerations in looking at software: goals, content validity, ease of use, attractiveness and attention-holding power, and possible conflict with community values. He observed that microcomputers can be used for a variety of applications, but they must be used with care.

"Evaluation: Teacher Performance," Dr. Charles Harrison, Tunica County Public Schools, Tunica, Mississippi

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DR. CHARLES HARRISON

DR. HARRISON is the Assistant Superintendent for Instruction in the Tunica County School System, Tunica, Mississippi. Dr. Harrison is responsible for overseeing a computer-assisted teacher performance appraisal system in his district, as well as serving on a state-wide Task Force for developing a state appraisal and compensation system. Dr. Harrison serves as Adjunct Professor in the Educational Administration Department at the University of Mississippi (Oxford) and acts as consultant to numerous school districts in developing performance evaluation systems for staff appraisal.

Dr. Charles Harrison's topic was the use of the microcomputer to help in an extensive performance evaluation program in one of the nation's poorest school districts. The objective of the teacher evaluation program was not to "hire and fire" teachers, but rather to achieve a 20% increase per year in student achievement.

Four years ago the Tunica County Public Schools started an Accountability and Instructional Management (AIM) program and spent a year examining effective schools literature and effective teaching literature in terms of management, curriculum, and teachers. The object of the search was to define a tool to capture data about the effective teaching act in order to impact student learning. Even though teachers do not directly affect student learning, effective teaching research shows that if teachers do certain things, students

spend more time on task, which does impact learning. Using Dr. Tom Romberg from the University of Wisconsin as a consultant, the Tunica school system devised a one-page classroom observation form.

Harrison explained the monitoring procedure in detail. Based on a frequency count of observed teacher and student behavior (engaged/off task, talking/listening, low feedback/high feedback, explaining content/explaining directions), the Tunica teachers are observed for one class period for a minimum of six times per year. In addition to all school principles, thirteen trained observors are also used for data collection, in the classrooms. For analyzing such masses of data, mainframe computers have been used by university researchers for years. However, a small district like Tunica must use microcomputers because of limited resources and expertise to handle 47 variables, 135 teachers, and six observations per teacher. The objective is to analyze average data on individual teachers on a system which is "user friendly" enough for a secretary to use. The Tunica microcomputer system has been programmed so that any combination of variables for school, grade, subject, and district can be referenced. A future step will involve a comparison of this district data with master teachers (Jane Stallings) in order to obtain a measure of quantum growth for the district. In conclusion, Harrison pointed out that the microcomputer printouts are given to principals and other administrators for qualitative analysis.

"The Effectiveness of Microcomputers in Education," Dr. Floyd Ploeger, Staff Associate, Regional Exchange Project, Southwest Educational Development Laboratory.

DR. FLOYD PLOEGER

DR. PLOEGER is a Staff Associate of the Regional Exchange, Southwest Educational Development Laboratory, and an Assistant Professor at Southwest Texas State University, San Marcos. A graduate of the University of Texas at Austin in Science Educaiton and Computer Science, Dr. Ploeger was previously Educational Coordinator for Central Texas for the Tandy Corporation and a high school science teacher at Travis High School in Austin. He was voted Outstanding Teacher in 1976 and 1977 and is the current President of Phi Delta Kappa and a member of Phi Kappa Phi (Austin chapter). He is the author of "Science Laboratory Safety Computer Program Simulation," The Monograph, the Science Education Center, The University of Texas at Austin.

Dr. Floyd Ploeger discussed the methodology and application of his research synthesis document, "The Effectiveness of Microcomputers in Education" and its shorter version, "Microcomputers in Education: A Quick Guide to the Research." He remarked that one must be careful in interpreting microcomputer research because gains scores do not necessarily reflect significant results. Research in microcomputers in education reflect several characteristics: most research has been conducted in the area of math; the so-called Hawthorne effect is not necessarily a negative effect since it is normal to change the environment with new things; and the computer language used for experimentation does not necessarily affect the effectiveness of the instruction or the relevance of the research.

He then listed a number of concerns and observations stemming from his research synthesis. Software should be less global and more specifically identified with the needs of the learner. Instructional mircocomputing is effective for young children if it is incorporated into the curriculum, but

ineffective if it is simply added as a piece of technology or an addition to the curriculum. Ploeger also remarked that any senior who graduates without learning something about the computer is at a competitive disadvantage. In the area of computer literacy, MECC (Minnesota Educational Computer Consortium) has determined that students improve in literacy simply because they have worked with machines; computer literacy does not need to be taught in and of itself because it is a natural by-product of instruction.

Ploeger also observed that many instructional programs do not require lengthy instructional objectives or screen displays because students may be capable of running the software themselves as they do in arcade games. The in the drill and practice simulations of typing software and pilot training. He concluded by saying that the application of software is a critical influence in the effectiveness of instructional microcomputers.

State Round-Up

Following the presentations representatives from each state department, region, district, and school were invited to discuss educational futures and options for the uses of microcomputers as educational tools in their respective states.

Arkansas:

The Instructional Resource Center in Little Rock has provided inservice mini-courses for 350 elementary and secondary teachers over two years. The first statewide computer conference will be held in November 1983. The Arkansas business community has pledged one-quarter million dollars in addition to $1 million state funds for instructional microcomputing; twenty-one school districts have been selected for participation. The Pine Bluff School

District has a pilot course in computer literacy for seniors which it expects to extend down to the ninth grade. The Microcomputer Lab, which was started through SEDL, now has 7 different microcomputers and over 200 pieces of software and is open to teachers and administrators for preview.

Louisiana:

The 35-member State Task Force has completed their computer literacy definition in a state task force report. Computer textbooks and software will come under a new textbook adoption category called "Computer Literacy/Education Textbooks and Software." A new taxation bill makes it possible for business to donate hardware and software to schools with a 40% tax write-off; orientation (in-service) and a 3-month maintenance contract must also be donated. For the 1984 World's Fair in New Orleans Louisiana will have a $1.5 million pavillion. Several problematic Federal House and Senate bills related to computer education were mentioned: HR 91, 701, 2417, 3098, and 3750 and SB 1194 and 1195. There was a request for more authoring software for teachers and more data-free, open-ended software. Statewide computer literacy workshops have been held in all major school districts. All colleges and universities offer computer literacy at the graduate level for classroom teachers.

Mississippi:

In May the State Department began a 2/3-time coordinator's position in instructional computing; an advisory committee has been formed and a position paper drafted, along with several pamphlets. A computer demonstration center for district personnel is being developed, and a workshop is planned for key legislators, school groups, and industry personnel for October. The small school district in Winona has established a junior-senior lab for compouter literacy. Natchez has developed a computer literacy program for staff and

students as well as guidelines for software evaluation. A statewide survey on the types of equipment and the way it is being used will be disseminated in November and the results will be used to set up a district file. The Mississippi Educational Computing Association has grown and has been developing a software clearinghouse with Appleswap.

Oklahoma:

The Stillwater Schools offer professional development in instructional microcomputing. The Professional Development Center will have its second annual conference in April. Plans are underway to network and access the mainframe at Oklahoma State to enlarge the software evaluation site. Oklahoma is looking at a statewide information exchange network which will provide information about software evaluation and availability in the schools. The state has also completed its first curriculum guide on computer use called "The First Byte: A Teacher's Guide to Classroom Computers."

New Mexico:

The Las Cruces district has approached the introduction of computers through small pilot projects. The high schools have labs for BASIC and PASCAL, with the business department teaching word processing. In nearly every grade level and subject matter there is a great deal of commercially produced software. Six junior high and elementary schools were selected for hardware and software acquisition. Two hundred teachers were trained at the teacher center the first year of the program. Four years ago the Georgefield schools instituted a database management system in math; now all schools have some form of computers. The New Mexico Computer Users in Education had 400 attendees at its conference last year. Albuquerque has passed a $5 million bond issue for hardware.

Texas:

The state curriculum in science and math is being revised within the total state curriculum revision; a separate course in computer literacy is being recommended. Certification requirements for teachers are also being reviewed and revised to include computer literacy. Funded projects of $700,000 are being slated for different service centers. Projects include statewide courseware evaluation, development of teacher training modules, development of business applications materials, and access to automated guidance/counseling tools. The TEA supports these projcts and also is involved in materials development and establishment of a statewide electronic network. The Texas Computer Educators Association has 12,000 members, with five area meetings and several state meetings each year; the TCEA is featuring student problem-solving contests, a computer literacy exam for the junior high, and a teacher contest for software and documentation.

R & D Speaks: Effectiveness of Microcomputers in Educational Applications

ARTICLES AND PAPERS:

"The Effectiveness of Microcomputers in Educational Applications: A Quick Guide to the Research," developed for the Southwest Educational Development Laboratory, Regional Exchange. Conference copy by Dr. F. Ploeger.

Bennett, Randy Elliot, "Applications of the Microcomputer Technology to Special Education," Exceptional Children, Vol. 49, No. 2, October, 1982. pp. 106-112.

Bracey, Gerald W. "Computers in Education: What the Research Shows," Electronic Learning, November-December, 1982. pp. 51-55.

Kulik, James A., et al., "Effects of Computer-Based Teaching on Secondary School Students," Journal of Educational Psychology, Vol. 75, No. 1, March, 1983. pp. 19-26.

Richards, John, "Who's in Charge? Playing an Active Role in Learning," (an interview with Judah Schwartz), Classroom Computer News, March-April, 1982. pp. 19-21.

Schwartz, Judah L. "The Semantic Calculator or Solving the 'Word-Problem' Problem," Classroom Computer News, March-April, 1982. pp. 22-24.

Schwartz, Judah L. "Tyranny, Discipline, Freedom, and License: Some Thoughts on Educational Idealogy and Computers," Draft of paper, MIT, Cambridge, MA, April, 1983.

RESOURCES AND MATERIALS:

Scholastic, Incorporated
902 Sylvan Avenue
Englewood Cliffs, NJ 07632

Software: MicroZine, interactive student magazine format

ERIC Clearinghouse
University of Illinois
805 W. Pennsylvania Avenue
Urbana, IL 61801-1386

Catalog: Articles and papers dealing with early childhood education and microcomputers

Sunburst Communications
39 Washington Avenue
Pleasantville, NY 10570

Software: Semantic Calculator (J. Schwartz), tool programs for for word and story problems

the microCenter
P.O. Box 6
Pleasantville, NY 10570

Provided the following software for display:

Math Blaster (Davidson and Associates)	Basic computation practice and speed
Teasers by Tobbs: Puzzles and Problem Solving (Sunburst Communications)	Mathematics and logic
Rocky's Boots (The Learning Company)	Machine logic and reasoning (8 yrs to adult)
MasterType (Lightning Software, Inc.)	Typing instruction and speed
Bank Street Writer (Broderbund Software)	Home word-processor for Apple II
Moptown Parade (The Learning Company)	Thinking and reasoning skills (6-10 yrs)

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September 27-28, 1983

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